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# Antarctic Ice Sheet dynamics in the Ross Sea during the Early to Middle Miocene

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A 1138-meter sediment core (AND-2A) recovered from the Southern McMurdo Sound sector of the Ross Sea comprises a near-continuous record of Antarctic climate and ice sheet variability through the Early to early Middle Miocene (20.2 to 14.5 million years ago), including an interval of inferred sustained global warmth known as the Miocene Climatic Optimum (MCO). The record preserves 55 sedimentary sequences that reflect cycles of glacial advance and retreat. A new analysis of proxy environmental data from the AND-2A core, and synthesis with regional geological information, show that the early to middle Miocene Antarctic climate ranged from cold polar conditions, similar to Antarctica during the Holocene, to those that characterise modern sub-polar environments. Four disconformities that punctuate the sedimentary sequence coincide with regionally mapped seismic discontinuities and reflect transient expansion of marine-based ice across the Ross Sea. The timing of these major marine-based ice sheet advances correlates with shifts in highly-resolved deep sea isotope records and major drops in eustatic sea-level indicating the global nature of these events. In contrast, three distinct intervals in the core indicate that this high latitude site was periodically influenced by an ice sheet margin that had retreated beyond the coastline. These relatively large-scale changes in climate and ice sheet extent occurred under atmospheric carbon dioxide concentrations that generally varied between 300 to 500 ppm. Therefore, our reconstructions suggest that Antarctica's climate and ice sheets were sensitive to modest changes in greenhouse gas forcing and support previous studies, which indicate that marine-based portions of the WAIS and EAIS can retreat under climatic conditions that were similar to those projected for our future under current levels of atmospheric $CO_2$.